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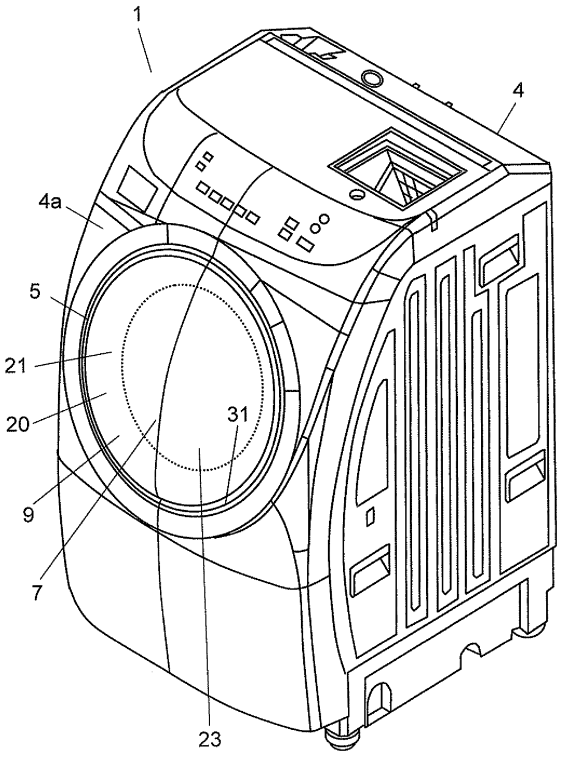
(54) Drum washing machine

(57) A drum washing machine (1) includes a lid (5) formed of a lid unit (8), having a transparent window (7) through which a user can monitor the laundry from the outside, and a transparent lid cover (9) for covering the lid unit (8). Multiple engaging tabs (9a) protruding rearward are provided to the rear face around the periphery of the lid cover, and multiple engagement stopper holes (8b) for receiving the engaging tabs (9a) and elastically engaging the tabs with engaging sections provided to the lid unit for preventing the tabs from slipping off. The tabs and the holes form multiple fixed sections which fit and fix the lid cover to the lid unit. Parts of the surface of the lid cover correspond to at least the fixed sections (9b) are shaped such that the parts at least refract or disperse the light from the inside when the light transmits through the lid cover.

FIG. 1



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a drum washing machine, in which a cylindrical rotary drum having a bottom plate is placed in a water tub such that the drum is oriented from an open front toward a rear bottom with its rotary axis kept horizontally or slanting downward. Laundry is put into the drum through a lid provided to a front face of a housing of the washing machine, and the drum is driven with a motor, thereby carrying out at least one of the steps of washing, rinsing, or dehydrating.

BACKGROUND OF THE INVENTION

[0002] A conventional drum washing machine includes a lid which is generally formed of a lid unit having a transparent window through which a user can see laundry, and a transparent lid cover fit to the front face of the lid unit for covering the lid unit. Such a drum washing machine is disclosed in, e.g. Unexamined Japanese Patent Application Publication Number 2007 - 68810 (hereinafter referred to as Patent Document 1). Patent Document 1 specifically discusses a transparent cover in its associated drawing, and this cover covers the front face of a lid frame as far as near to the outer rim of the frame. This conventional structure reveals a problem, i.e. fitted sections of snaps, which elastically engage the transparent lid cover with the lid frame and fix the cover to the lid frame, can be seen from the front, so that a fine appearance of the drum washing machine is somewhat spoiled. To overcome this problem, Patent Document 1 thus proposes an opaque decorative plate be fitted onto an outer periphery of the transparent lid cover for exhibiting a fine appearance of the drum washing machine.

[0003] However, use of this decorative plate needs additional components and manufacturing steps, thereby incurring an increase in the manufacturing cost. The transparence of the lid cover is actually not needed in a range not contributing to see-through the laundry, yet placement of the decorative plate loses the transparence of the lid cover at the periphery of the cover. As a result, a quality look, compactness, and a fine appearance of the entire lid are spoiled, so that another problem occurs such as an increase in the cost, and degradation in the compactness as well as in the fine appearance of the drum washing machine.

SUMMARY OF THE INVENTION

[0004] The present invention addresses the problem discussed above, and aims to provide a drum washing machine, in which a lid cover is transparent as far as its periphery where the cover is elastically engaged with and fixed to the lid unit. Yet this drum washing machine needs no additional components or assembling steps, so that the washing machine can be inexpensive and compact. On top of that, the fixed sections are not viewed from the outside, so that the washing machine can exhibit its compactness, a quality look, and a fine appearance.

[0005] The drum washing machine of the present invention includes a cylindrical rotary drum having a bottom plate and placed in a water tub such that the drum is oriented from an open front toward a rear bottom while its rotary axis is kept horizontally or slanting downward. Laundry is put into the drum through a lid provided to a front face of a housing of the washing machine, and the drum is driven with a motor, thereby carrying out at least one of the steps of washing, rinsing, or dehydrating. The lid is formed of a lid unit having a transparent window through which a user can monitor the laundry, and a transparent lid cover placed on the front face of the lid unit for covering the lid unit. Multiple engaging tabs are provided on a rear face at the periphery of the cover, and the engaging tabs protrude rearward. Multiple engagement stopper holes to be mated with the engaging tabs are provided to the lid unit. The holes receive the tabs into the lid unit and elastically engage the engaging tabs with engaging sections provided to the lid unit for preventing the tabs from slipping-off. The tabs and the holes form multiple fixed sections which fit and fix the lid cover to the lid unit. The surface of the cover corresponding at least to the fixed sections has a surface shape which at least refracts or disperses a light from the inside when the light transmits through the cover.

[0006] The structure discussed above allows preventing at least the wash water, rinse water, or a splash produced by a spin-dryer from leaking to the outside during the respective corresponding steps. On top of that, the user can monitor the laundry through the transparent lid cover and the window while the machine carries out at least one of the steps of washing, rinsing, or dehydrating.

[0007] Although the lid cover remains transparent at least in the regions corresponding to the fixed sections, the shape of the lid cover allows the light from the inside of the drum washing machine to be refracted or dispersed when the light transmits through the surface of the cover. Thus the light reflected on the fixed section is at least refracted or dispersed when the light transmits through the surface of the lid cover. As a result, the foregoing structure allows the fixed sections, which are desirably not viewed from the outside, not to be exposed expressly to the human eyes without any additional components or any additional manufacturing steps. As the surface which at least refracts or disperses the light from the inside, a finely-embossed face referred to as a satin-finished face is not employed because the light is diffusely reflected. The surface can be a rough face having a pattern of peaks and valleys instead. The transparence of the regions corresponding to the fixed sections is spoiled little or an interior structure, e.g. the fixed sections, is not exposed to the human eyes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 shows a perspective view illustrating an essential structure of a drum washing machine in accordance with an embodiment of the present invention.

Fig. 2 shows a sectional view of the drum washing machine shown in Fig. 1.

Fig. 3A shows a sectional view in parts of the drum washing machine shown in Fig. 1, specifically, it shows an inlet/outlet for laundry and a lid closing the inlet/outlet.

Fig. 3B shows a sectional view enlarging a fixed section and its vicinity shown in Fig. 3A.

Fig. 4 shows a perspective view illustrating a relation between a lid cover and a front frame of a lid placed in a water tub of the drum washing machine shown in Fig. 1.

Fig. 5 shows a partial perspective and enlarged view in parts of the front frame shown in Fig. 4.

Fig. 6 shows a front view of the lid cover of the drum washing machine shown in Fig. 1.

PREFERRED EMBODIMENT OF THE INVENTION

[0009] An exemplary embodiment of a drum washing machine of the present invention is demonstrated hereinafter with reference to the accompanying drawings. The following embodiment is only an example, and the present invention is not limited to this embodiment. Dimensions in the drawings are sometimes enlarged or reduced for describing structures for a simpler description. Similar elements in the drawings have the same reference marks, and the descriptions thereof are sometimes omitted.

Exemplary Embodiment

[0010] Fig. 1 shows a perspective view illustrating an essential structure of the drum washing machine in accordance with the embodiment of the present invention. Fig. 2 shows a sectional view of the drum washing machine shown in Fig. 1.

[0011] Drum washing machine 1 in accordance with this embodiment includes rotary drum 2 having a bottom plate, and drum 2 is placed in water tub 3 such that drum 2 is oriented from a open front toward a rear bottom with its rotary axis kept horizontally or slanting downward. A user can put laundry into drum 2 through lid 5 provided to the front section of washing machine housing 4, and rotary drum 2 is driven by motor 6, so that at least one of the steps of washing, rinsing, or dehydrating can be carried out.

[0012] Fig. 3A shows a sectional view in parts of the drum washing machine shown in Fig. 1, specifically, an inlet/outlet for the laundry and a lid 5 closing the inlet/outlet. Fig. 3B shows a sectional view enlarging a fixed section and its vicinity shown in Fig. 3A. Fig. 4 shows a perspective view illustrating a relation between a lid cover and a front frame of the lid in the water tub of the drum washing machine shown in Fig. 1. Fig. 5 shows a partial perspective and enlarged view in parts of the front frame shown in Fig. 4. Fig. 6 shows a front view of the lid cover of the drum washing machine shown in Fig. 1.

[0013] Lid 5 shown in Figs. 1 and 2 is formed of lid unit 8 having transparent window 7 through which a user can see the laundry from the outside as shown in Figs. 2 and 3A, and transparent lid cover 9 fitted on the front face of lid unit 8. Lid cover 9 has multiple engaging tabs 9a protruding rearward and integrally formed therewith on its rear face along its periphery as shown in Figs. 3A and 4. Lid unit 8 has multiple engagement stopper holes 8b corresponding to engaging tabs 9a. Each one of stopper holes 8b receives tab 9a as shown in Fig. 3A, elastically engages tab 9a with engaging section 8a for preventing tab 9a from slipping-off, and fits and fixes lid cover 9 to lid unit 8. The foregoing structure allows lid cover 9 to fit and cover lid unit 8 on the front face, and lid cover 9 is fixed to lid unit 8. Lid cover 9 has positioning projection 41 as shown in Fig. 4 for being mated with positioning hole 42 provided to lid unit 8. Thus engagement stopper hole 8b, which is prepared to lid unit 8 correspondingly to multiple engaging tabs 9a, is not available only to positioning projection 41 although stopper hole 8b is available to each one of engaging tabs 9a.

[0014] The foregoing structure of fixing lid cover 9 to lid unit 8 exhibits an idea about exposing a fixed section 11 formed of engaging tab 9a and engagement stopper hole 8b not expressly to the outside without losing the transparence of lid cover 9. To be more specific, as shown in Fig. 6, lid cover 9's surface in parts 9b respectively corresponding to at least fixed sections 11 are shaped such that the light from the inside can be at least refracted or dispersed while it transmits through lid cover 9. Surface in parts 9b is shaped, e.g. as shown in Fig. 3A and Fig. 3B, and this shape allows refracting or dispersing the light as indicated with the solid line arrow marks or broken line arrow marks in Fig. 3A.

[0015] The structure discussed above allows transparent lid cover 9 to fit on the front face of lid unit 8, and allows engaging elastically tabs 9a protruding rearward along the periphery of lid cover 9 with engaging sections 8a of engagement stopper holes 8b provided to lid unit 8 for fixing cover 9 to lid unit 8. When cover 9 is fixed to lid unit 8 as discussed above, lid cover 9's surface in-parts 9b corresponding at least to engagement stopper holes 8b and fixed sections 11 respectively refract or disperse the light from the inside because of their shapes although they remain transparent. As a result, the light reflected on engaging section 8a and fixed section 11, which is formed of engagement stopper hole 8b and engaging tab 9a, is refracted or dispersed as shown with the arrow marks while the reflected light transmits through surface in-parts 9b of lid cover 9. The structural

elements desirably not to be exposed to the outside, such as engaging section 8a, cannot seen expressly with human eyes because the light is refracted or dispersed as shown with the solid or broken arrow marks. This structure needs no additional components or no additional assembling steps.

[0016] A fine-embossed face is not employed as surface in-parts 9b because the fine-embossed face invites diffuse reflection which somewhat loses the transparence. In stead, a rough face with a pattern of peaks and valleys is employed because it hides desirably-invisible structures such as engaging section 8a from the human eyes or prevents the shades thereof from being reflected.

[0017] The structure discussed above allows preventing the wash water, rinse water, or a splash produced by a spin-dryer from leaking to the outside during the respective corresponding steps with lid 5 closed. The user can monitor the laundry through transparent lid cover 9 and window 7 while the machine carries out the steps of washing, rinsing, or dehydrating. On top of that, as shown in Figs. 3A, 3B, and 5, surface in- parts 9b placed along the periphery of lid cover 9 correspond to at least the locations of engaging sections 8a, and the shape of surface in- parts 9b are modified, with their transparence maintained, such that the light reflected on fixed section 11 can be refracted or dispersed. As a result, desirably-invisible structural elements such as engaging sections 8a are kept not seen expressly with the human eyes while lid cover 9 maintains its transparence or transparent feeling, and yet, lid cover 9 exhibits a quality look. On top of that, the modification provided to surface in-parts 9b needs no additional components or no additional assembling steps, so that the structure discussed above incurs no increase in the manufacturing cost of the drum washing machine. To be more specific, the modification provided to the surface includes, e.g. a rough face having a pattern of peaks and valleys, which prevents the shade of fixed sections 11 from being reflected to the outside, but excludes a fine-embossed face which incurs the diffuse reflection that loses transparence greatly enough to hide the interior structures from the human eyes. Lid cover 9 with surface in-parts 9b placed along the periphery as shown in Fig. 6 and having the foregoing rough face with the pattern of peaks and valleys exhibits somewhat a decorative appearance.

[0018] Lid cover 9 is formed of resin, in general, such as synthetic resin. As shown in Fig. 3A and 3B, lid cover 9 extends around the outer wall of lid unit 8 and covers lid unit 8 with its extending and surrounding wall 9c. End face 9d of surrounding wall 9c includes engaging tabs 9a integrally molded with lid cover 9. Lid unit 8 includes, along its periphery, projecting wall 8d projecting outward from the periphery of lid unit 8 and having stepped face 8c confronting end face 9d. Engagement stopper hole 8b extends through this projecting wall 8c from the front to the rear. The foregoing structure allows transparent lid cover 9 to extend around the outer wall of lid unit 8 and covers lid unit 8, so that the human eyes along a slant line from the front-side or the front-upper into the interior can be blocked. As a result, lid cover 9 extends its transparent wall uniformly to a wider area including the periphery, so that drum washing machine 1 can exhibit an appearance of better quality look.

[0019] Fixed section 11 comprises the following structural elements:

engaging hole 9e as shown in Fig. 3A and 3B or an engaging hook provided to engaging tab 9a ; and

either one of engaging section 8a shaped like a snap for a non-return purpose provided to an inner wall of engagement stopper hole 8b or a rear open edge of stopper hole 8b for being elastically engaged with engaging hole 9e or the engaging hook.

The foregoing structure allows lid cover 9 to be fixed to lid unit 8 through the elastic engagement with each other.

[0020] Lid unit 8 includes lid frame 20 which comprises front frame 21 and rear frame 22 made of synthetic resin, and transparent window-board 23 made of transparent synthetic resin and sandwiched between front frame 21 and rear frame 22. Front frame 21 and rear frame 22 confront each other with transparent window-board 23 sandwiched in between, thereby forming window 7.

[0021] Projecting wall 8d of lid unit 8 is provided to front frame 21, and the surrounding wall 9c extending around the outer wall of lid unit 8 is generally flush with the outer surface of projecting wall 8d. Rear frame 22 includes flange 22a facing outward at its front end for being fitted to front frame 21. Flange 22a is mated with step 21a at rear inside of projecting wall 8d. This structure allows lid frame 20 to be integrated to one unit with front frame 21 and rear frame 22. In this case, front frame 21 is elastically engaged with lid cover 9, and these two elements can be handled as one single member, or rear frame 22 sandwiches window-board 23 with front frame 21, and these three elements can be handled as one single member. Then lid cover 9 is fitted to front frame 21 for elastically engaging with each other, and they can be fixed to each other. On top of that, surrounding wall 9c of lid cover 9 is generally flush with the outer face of projecting wall 8d, so that outer surface 9f of lid cover 9 extends to a wider area including a three-dimensional region and is simplified. Rear frame 22 includes flange 22a facing outward at its front end for fitting to front frame 21. Flange 22a is mated with step 21a inside the rear end of projecting wall 8d. An outer wall of rear frame 22 is thus located inside the outer walls of lid cover 9 and front frame 21, so that a region viewed from the outside, with lid cover 9 closed, gives a less thick image to the users.

[0022] Surface in parts 9b, placed on lid cover 9 correspondingly to at least fixed sections 11, are modified in their shape for the light from the inside to be refracted or dispersed when the light transmits through lid cover 9. This modified surface-shape can be one of the following shapes: (1) An annular or an arc shaped wrinkle grooved in a radial direction as shown with broken-line

arrow marks in Fig. 3A, (2) Annular or arc wavy form grooved in the radial direction as shown with solid-line arrow marks in Fig. 3A, or (3) rough surface with peaks and valleys formed thereon and extending in every direction. Use of one of the foregoing shapes on the surface in-parts 9b allows preventing the fixed section 11 including the engaging section 8a from being viewed from the outside because of the foregoing pattern which does not lose the transparence. Surface in-parts 9b should not undergo a finely embossing process in order not to lose the transparence. Thus for instance, the pattern of peaks and valleys extending in every direction should have a roughness greater than a knurled pattern.

[0023] The structure discussed above is further detailed hereinafter. As shown in Figs. 1 and 2, housing 4 of the washing machine includes uphill slant face 4a at the upper front, and round inlet/outlet 31 of laundry is formed on this slant face 4a. Lid 5 is hinged to inlet 31 to open or close inlet 31 and is roundly shaped like inlet 31. Front frame 21 of lid frame 20 is molded of, e.g. polypropylene, and rear frame 22 is molded of, e.g. polypropylene having greater resistance against chemicals than the other one. Window board 23 is made of, e.g. glass, and lid cover 9 is formed of, e.g. transparent ABS resin. Placement of positioning projection 41 allows identifying how to mount cover 9 to lid unit 8 with ease, so that no wrong mounting can be expected. This simple mounting of cover 9 to lid unit 8 can advantageously avoid wondering which way cover 9 should be mounted, thus cover 9 can be mounted free from flaws. A wider transparent area is obtained on lid cover 9 of lid 5, and yet, fixed section 11 including engaging section 8a, which engages cover 9 with lid unit 8 behind lid cover 9, is prevented from being viewed from the outside of drum washing machine 1 of which rotary drum is placed horizontally or slanting downward.

[0024] The drum washing machine of the present invention allows the user to watch the laundry through the transparent lid cover and window with the lid closed while washing water, rinsing water, or hydrating splash is prevented from leaking to the outside. On top of that, the transparent lid cover is fitted on the front face of the lid unit and elastically engaged with the lid unit, and yet, a structure desirably non-visible from the outside, such as the fixed section including the engaging section, is prevented from being viewed expressly from the outside.

[0025] To be more specific, the surface in parts of the lid cover correspond to at least respective fixed sections, and the surface in-parts are kept transparent although they are modified their surface-shape in order to allow refracting or dispersing the transmitting light reflected on the engaging section. This structure allows not losing the transparence or transparent image of the lid cover, and yet not reducing the transparent area, while the interior structure can be prevented from being viewed from the outside. As a result, the drum washing machine with a quality look is obtainable. No additional components or no additional manufacturing steps are needed for achieving this drum washing machine exhibiting the quality look, so that no additional manufacturing cost is expected. The surface in-parts corresponding at least to the respective fixed sections avoid using finely-embossed process, which incurs the loss in the transparence due to diffusion reflection, but employ a pattern of peaks and valleys which prevents the fixed section including the engaging section from being viewed from the outside. The foregoing pattern exhibits transparent image as well as a quality look, thereby providing the drum washing machine with decorative feeling and a fine appearance.

[0026] The drum washing machine of the present invention allows obtaining a wide transparent area on its lid cover behind which the engaging section elastically engages the lid cover with the lid unit, and yet, this engaging section can be prevented from being viewed expressly from the outside. The lid can be modified as discussed above free from additional cost. The drum washing machine is thus of use to the users because of its compactness and fine appearance.

Claims

1. A drum washing machine, in which a cylindrical rotary drum having a bottom plate is placed in a water tub such that the drum is oriented from an open front toward a rear bottom with its rotary shaft kept horizontal or slanting downward, and in the drum washing machine, laundry is put into the drum through a lid provided to a front section of a housing of the washing machine, and the drum is driven with a motor, thereby carrying out at least one of the steps of washing, rinsing, or dehydrating,
wherein, the lid comprises:

a lid unit having a transparent window through which the laundry can be monitored externally; and
a transparent lid cover fitted on a front face of the lid unit for covering the lid unit,

wherein a plurality of engaging tabs projecting rearward and placed on a rear face of an outer periphery of the lid cover , and a plurality of engagement stopper holes provided to the lid unit for receiving the engaging tabs and elastically engaging the engaging tabs with engaging sections provided to the lid unit for preventing the engaging tabs from slipping off and fixing the lid cover to the lid unit, form a plurality of fixed sections of the lid unit and the lid cover,
wherein a surface of the lid cover corresponding to at least one of the fixed sections has a surface-shape which allows a light from inside of the washing machine to be at least refracted or dispersed when the light transmits through the lid cover.

2. The drum washing machine of claim 1, wherein the

lid cover has an surround wall extending and surrounding an outer periphery of the lid unit, and the engaging tab is integrally molded with an end face of the surrounding wall, and
a projecting wall, which projects outward and includes a step, is integrally molded with the lid unit and placed on the outer wall of the lid unit such that the step confronts the end face, and the engagement stopper hole extends through the projecting wall from front to rear of the projecting wall.

3. The drum washing machine of claim 1 or claim 2, wherein the fixed section includes:

an engaging hole or an engaging hook provided to the engaging tab; and
a snap provided to an inner wall of the engagement stopper hole for being elastically engaged with one of the engaging hole and the engaging hook; and
a rear open edge of the engagement stopper hole.

4. The drum washing machine of claim 3, wherein the lid unit includes:

a front frame and a rear frame forming a lid frame; and
a transparent window board sandwiched between the front frame and the rear frame,

wherein the projecting wall is provided to the front frame, and an outer surface of the surrounding wall of the lid cover is generally flush with an outer surface of the projecting wall, and the rear frame includes a flange facing outward at its front end for fitting to the front frame, and the flange facing outward is mated with a step provided rear inside of the projecting wall.

5. The drum washing machine of claim 1, wherein the surface shape is one of

(1) an annular or an arc shaped wrinkle grooved in a radial direction;
(2) annular or arc wavy form grooved in the radial direction; and
(3) rough surface with peaks and valleys formed thereon and extending in every direction.

6. The drum washing machine of claim 2, wherein the surface shape is one of

(1) an annular or an arc shaped wrinkle grooved in a radial direction;
(2) annular or arc wavy form grooved in the radial direction; and
(3) rough surface with peaks and valleys formed thereon and extending in every direction.

7. The drum washing machine of claim 3, wherein the surface shape is one of

(1) an annular or an arc shaped wrinkle grooved in a radial direction;
(2) annular or arc wavy form grooved in the radial direction; and
(3) rough surface with peaks and valleys formed thereon and extending in every direction.

FIG. 1

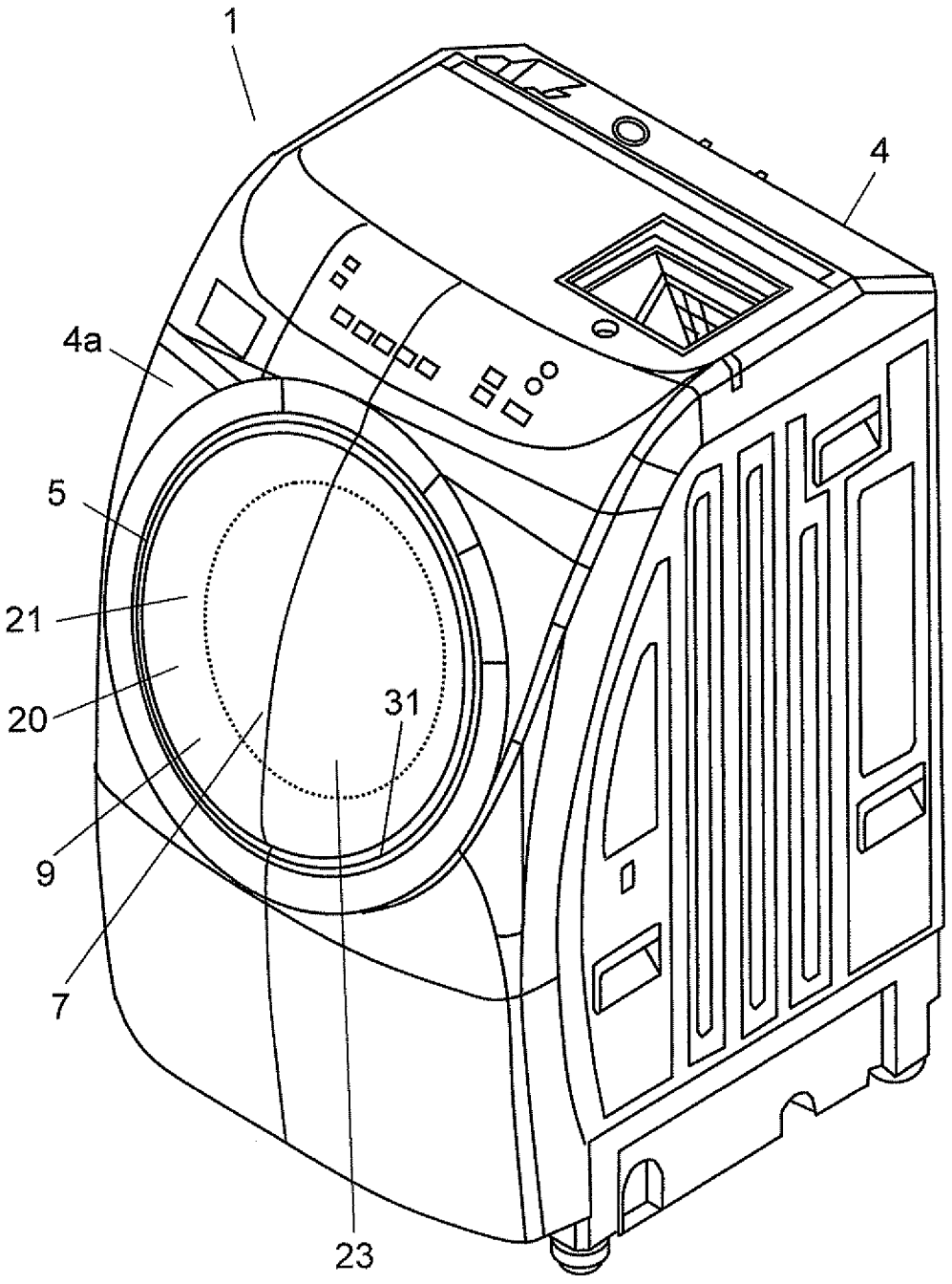

FIG. 2

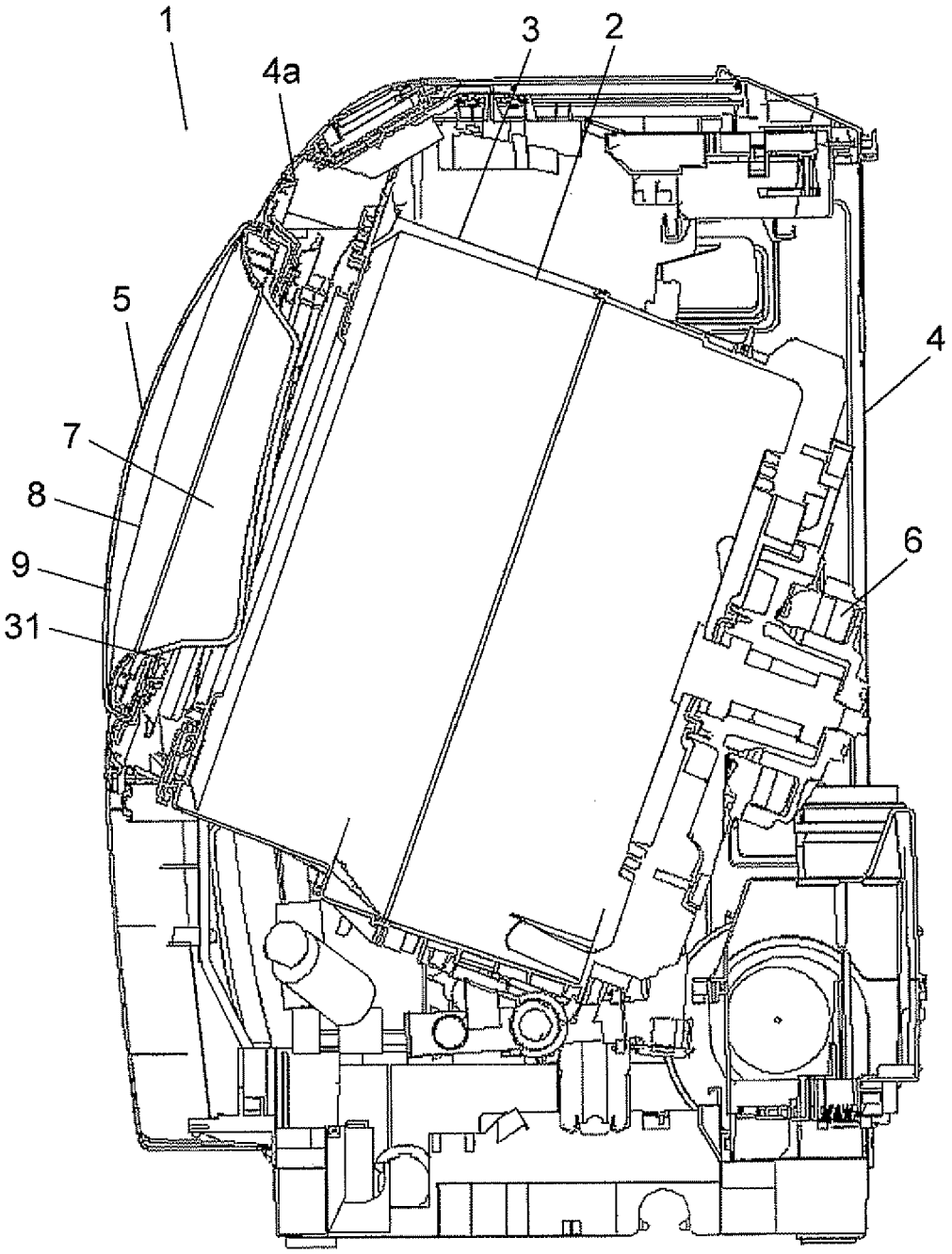

FIG. 3A

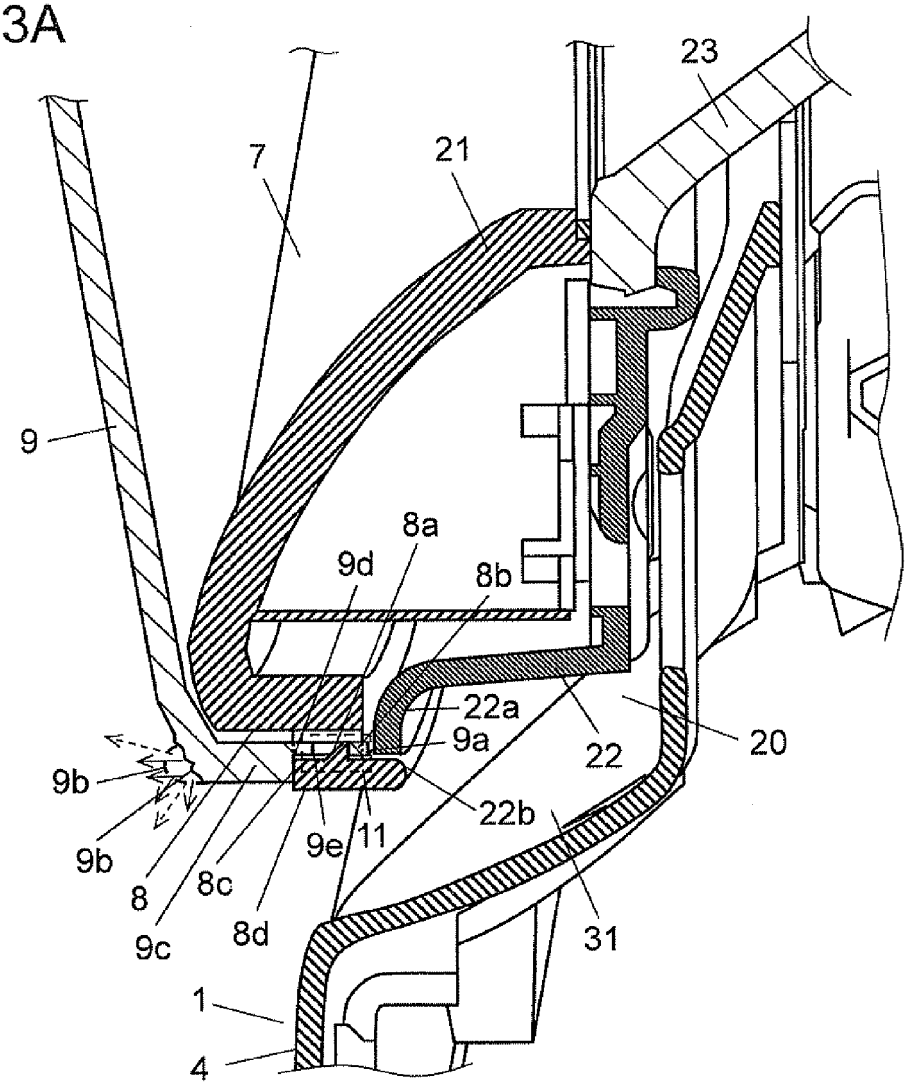
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FIG. 3B

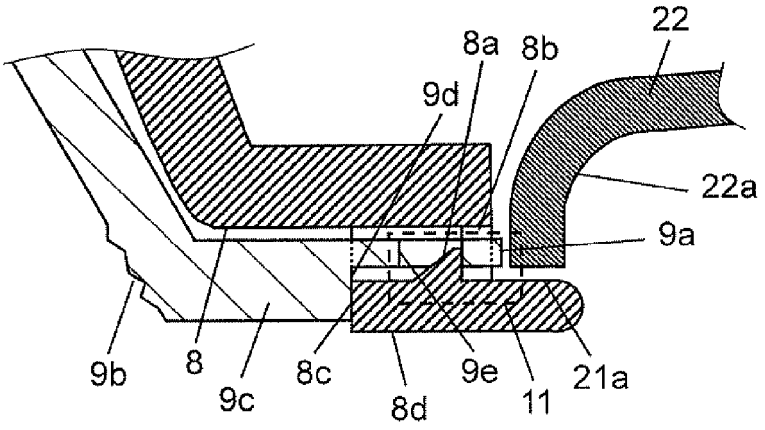
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FIG. 4

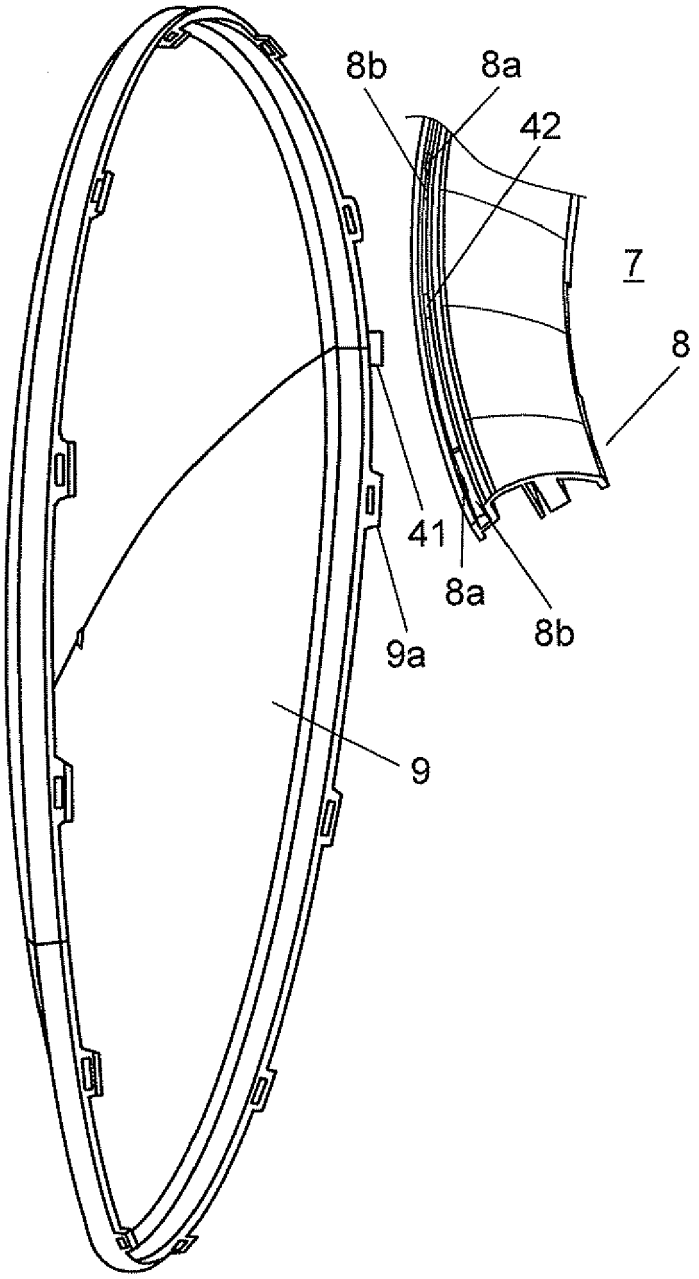


FIG. 5

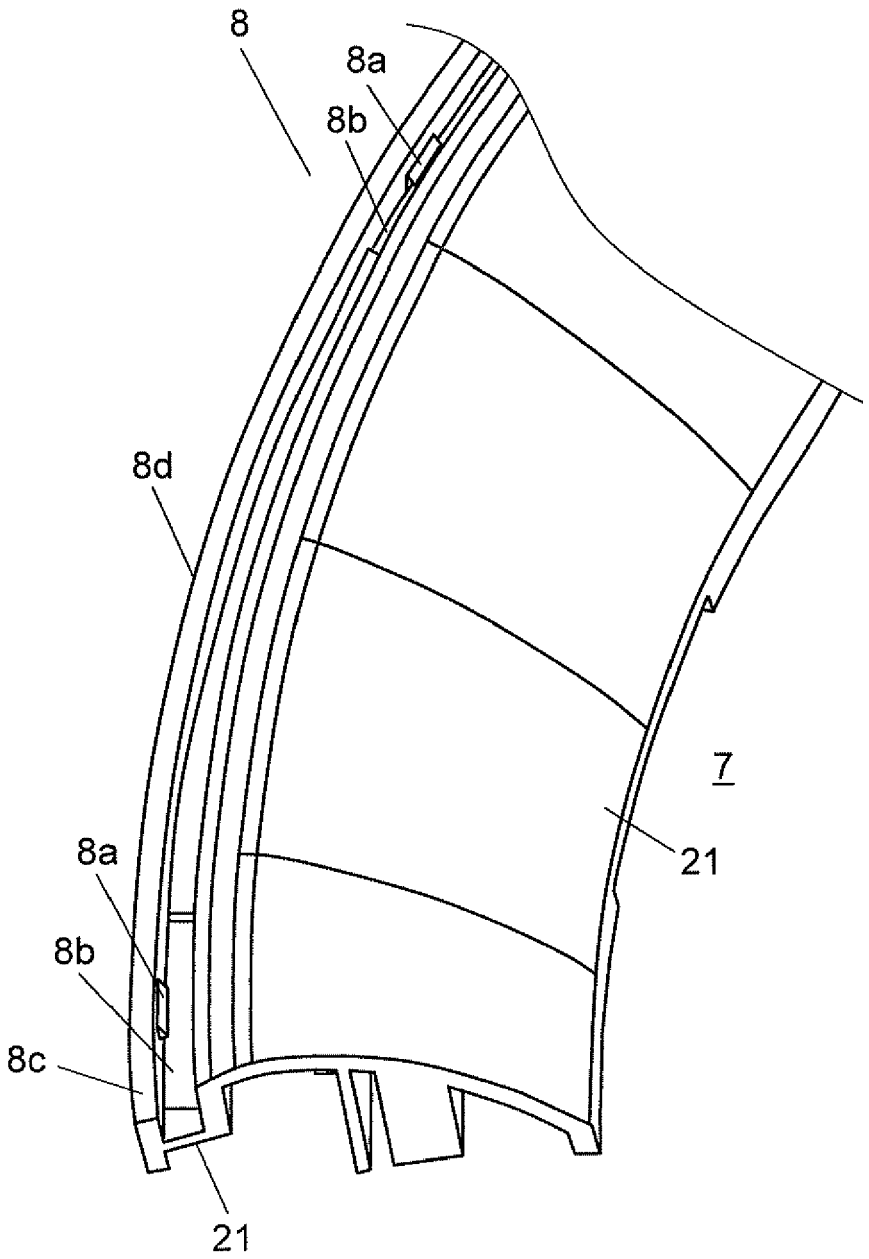
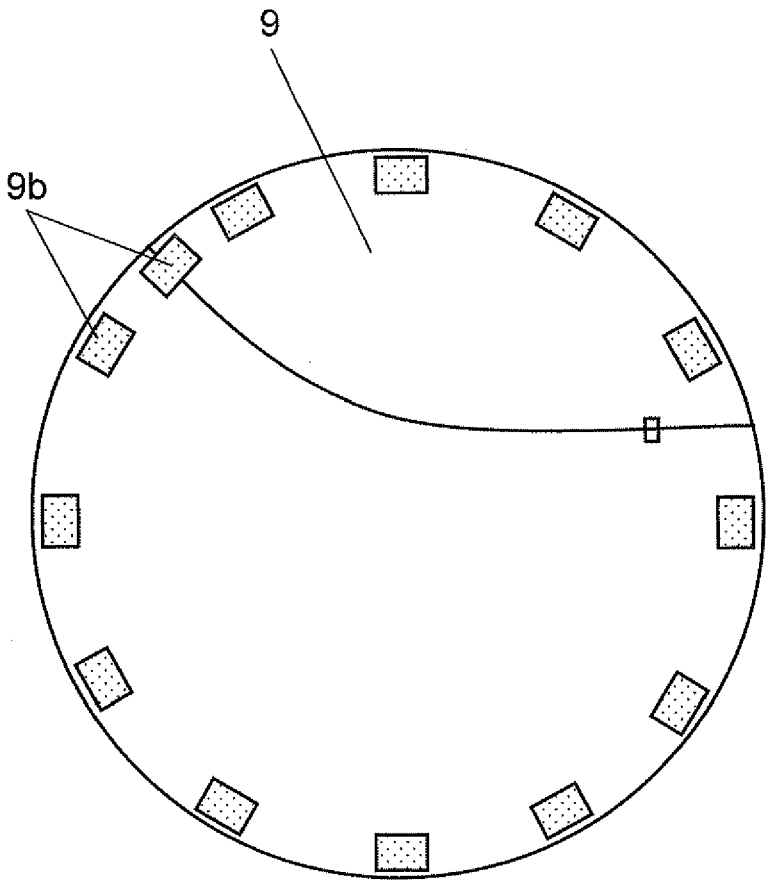


FIG. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 09 15 0430

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 195 15 040 A1 (BOSCH SIEMENS HAUSGERAETE [DE]) 31 October 1996 (1996-10-31) * column 2, line 67 - column 3, line 67; figures 1-8 *	1-7	INV. D06F39/14
X	US 2006/117813 A1 (HA YOUNG H [KR] ET AL) 8 June 2006 (2006-06-08) * paragraph [0016] - paragraph [0029]; figures 1-15 * * paragraph [0061] - paragraph [0110] *	1,3-7	
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P,X	JP 2008 253488 A (TOSHIBA CORP; TOSHIBA CONSUMER ELECTRONICS H; TOSHIBA HOME APPLIANCES) 23 October 2008 (2008-10-23) * abstract; figures 1-13 *	1-7	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 May 2009	Richmond, Sarah

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 15 0430

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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